

Title	CONTRIBUTIONS TO JAPANESE ASCIDIAN FAUNA - XII. SPORADIC MEMORANDA (3)-
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Citation	PUBLICATIONS OF THE SETO MARINE BIOLOGICAL LABORATORY (1958), 6(3): 313-325
Issue Date	1958-06-20
URL	http://hdl.handle.net/2433/174590
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Type	Departmental Bulletin Paper
Textversion	publisher

CONTRIBUTIONS TO JAPANESE ASCIDIAN FAUNA

XII. SPORADIC MEMORANDA (3)¹⁾

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With 6 Text-figures

The five species of ascidians described here were all collected from the Japanese waters; three of which are new species, while other two are new to Japanese ascidian fauna. They are:

- | | |
|--|---------------|
| 1. <i>Lissoclinum japonicum</i> n. sp. | Sirahama, Kii |
| 2. <i>Echinoclinum verrilli</i> VAN NAME | Sagami Bay |
| 3. <i>Pseudodistoma fragilis</i> n. sp. | Sagami Bay |
| 4. <i>Distaplia systematica</i> n. sp. | Sirahama, Kii |
| 5. <i>Polycarpa pedata</i> HERDMAN | Sirahama, Kii |

Among these, the third species *Pseudodistoma fragilis* n. sp. is most interesting in that it bears apparently the appearance of *Pseudodistoma* of Polyclinidae on one hand and at the same time it shows some resemblance with *Distaplia* of Polycitoridae on the other hand, thus it seems to present an intermediate state between the two families.

1. *Lissoclinum japonicum* n. sp.

(Fig. 1)

A single colony was found on the ocean-side of Hatakezima in the vicinity of the Seto Marine Biological Laboratory, Sirahama. It is roughly a small cubic mass, 15 mm × 8 mm in extent and 2.5–3 mm in thickness. The surface of the colony is quite even and grayish purple in colour when it is alive, but turns to grayish tint in preservatives. The inside of the colony is pure white, this is evidently due to the existence of calcareous spicules within the test. There are about forty roundish branchial apertures scattered over the surface, without forming any system; besides two common cloacal apertures which are two or three times as large as branchial apertures. All branchial apertures are small, but very distinct, opened clearly and each fringed with six lobules as shown in 2 of the Text-figure. There are very spacious thoracic lacunae,

1) Contributions from the Seto Marine Biological Laboratory, No. 311.

while the abdomens are embedded in the bottom layer. Spicules are distributed evenly and densely throughout the test from the surface to the bottom. They are mostly $21\text{--}33\ \mu$ in diameter, being $25\ \mu$ on an average. They consist of many short and bluntly pointed rays, up to 15–20 in number on the equatorial plane. The purplish pigment is confined to only the superficial layer of the colony. Zooids are dark red

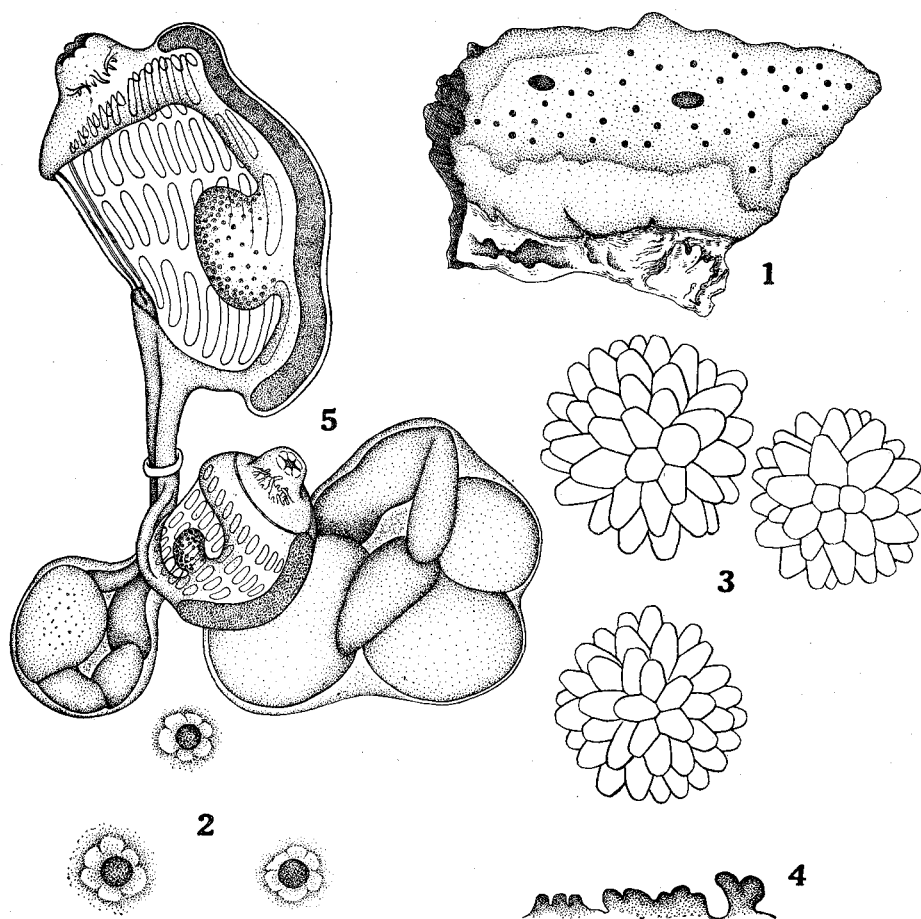


Fig. 1. *Lissoclinum japonicum* n. sp.

1...Colony, \times ca. 4; 2...Three branchial apertures, $\times 23$; 3...Calcareous spicules, $\times 1200$; 4...Margin of branchial aperture, magnified; 5...Zooid, $\times 47$.

when they are alive. Thorax is ca. $1200\ \mu$ and abdomen is ca. $920\ \mu$ in length; both parts are strongly constricted off from each other and resultantly the neck region is formed very remarkably. Usually thoracic and abdominal buds are formed; the former from the oesophageal region and the latter from the cardiac portion of the mother individual. Branchial aperture six-lobed, each may be subdivided into two or three lobules.

The atrial aperture is a large opening, the second to the fourth stigmatal rows are nearly wholly exposed; the atrial languet is not observed. The lateral margin of the atrial aperture is protruded on each side towards the out-dorsal side at the level of the third stigmatal row, and there the roundish thoracic organ is formed and many small spicules are contained within it. Stigmatal rows four; anterior two rows contain respectively 10 stigmata on each side, the third eight and the fourth seven. Dorsal languets three, slightly displaced to the left side from the dorso-median line. Tentacles 16, four large and four small ones alternate regularly and every interval is intervened by minute tentacle. A pair of thin longitudinal muscles are running along the dorso-median line of the branchial sac. The anus is situated at the dorso-posterior corner of the thorax and bilobed. The hind-stomach is distinct; the mid-intestine is defined, but very indistinctly. Testicular follicles two.

Remarks: The present species differs apparently from *Lissoclinum fragile* (VAN NAME) in colouration, the latter being snowy white in colour. *Diplosomoides ostrearinum* MICHAELSEN from S. W. Australia and the Great Barrier Reef resembles closely the present species in colouration, but differs from the latter in the form of the atrial aperture which is not so wide as in the present new species.

Diplosomoides caulleryi RITTER & FORSYTH from San Diego Bay and the Juan Fernandez Islands conforms with the present new species in the structure of the colony and in the appearance of the large atrial aperture. The present new species, however, is distinctly separable from any of the above-mentioned three already known species by its characteristic situation and appearance of the thoracic organ.

2. *Echinoclinum verrilli* VAN NAME, 1902

(Fig. 2)

VAN NAME, W. G. (1902): The ascidians of the Bermuda Islands. Trans. Connecticut Acad. Sci., Vol. 11, p. 372, pl. 50 figs. 23-25.

Four minute colonies attached to a polychaete nest collected from the 10 fathoms deep of Miyose-no-takane off Nagai in Sagami Bay. Two larger colonies are respectively 3×2 mm and 6×2 mm in extent and ca. 1.5 mm in thickness. The former contains 15 zooids and the latter 23 zooids. The test is gelatinous, very soft, transparent, and contains white spicules rather densely in the surface layer, but sparsely in the zooidal and lower layers. A single small and oval common cloacal aperture is found on each colony. Spacious thoracic lacunae are developed. The specimens are coloured yellowish white when they are alive. Spicules are very characteristic in their tetrahedron shape, with apices produced into considerably elongated points. They are large and vary, in the present material, from 70 to 120 μ in diameter measured from point to point. The thorax is up to 730 μ and the abdomen attains to nearly the same length, but becomes larger when the testis is fully matured. The neck region is defined very clearly by strong constriction. The branchial aperture

6-lobed, the atrial aperture is a wide opening. The thoracic organ is an elliptical pocket situated approximately at the centre of each lateral side of the thoracic mantle. Stigmatal rows 4, each row contains ca. six stigmata. Tentacles ca. 12. The stomach is globular, the hind-stomach is distinct and elongate, the mid-intestine is very short. Only one testicular lobe is present, the proximal portion of the vas deferens is straight.

Remarks: There is no doubt about the identity of the present specimen with *E. verrilli* VAN NAME which is, however, known only from the West Indies, namely Bermuda and the coastal waters of Florida. So this seems to be the first report from other parts of the world else than the above-mentioned locality. Probably the present species might be distributed widely in the warm-water regions of the world.

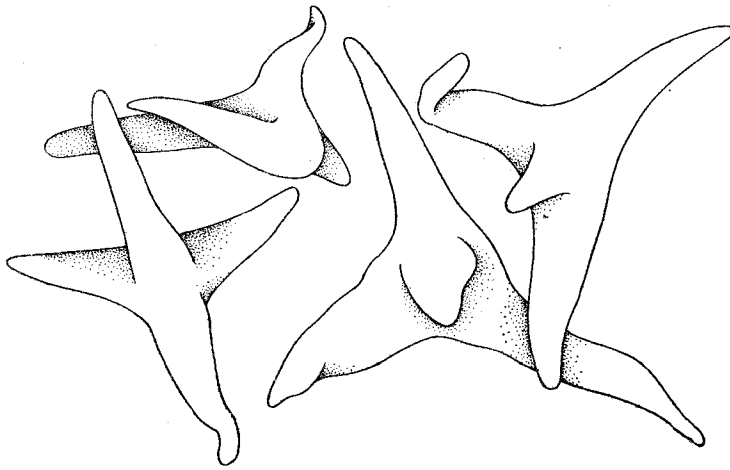


Fig. 2. *Echinoclinum verrilli* VAN NAME. Calcareous spicules, $\times 626$.

3. *Pseudodistoma fragilis* n. sp.

(Fig. 3)

Three colonies in the present material. They were all collected from the ten fathoms deep of Miyose-no-takane off Nagai in Sagami Bay respectively on July 14, 15 and 16, 1955. The colony of July 15 measures 75×85 mm in extent and 2–6 mm in thickness, that of July 16 is 21×30 mm in extent and 3 mm in thickness, while the specimen of July 14 is quite mutilated and zooids are all gone out of the torn test. The test is quite transparent or faintly milky-white and translucent, gelatinous and extremely fragile being easily torn into a mucous substance. The colonies are usually encrusting coarse sands and gravels. Zooids are comparatively large, up to ca. 12 mm when they are expanded. It is about 4.5 mm long when the thorax and the abdomen are measured together, both parts are nearly equal in length; the post-abdomen is not protruded out from the strictly posterior end of the abdomen, but

rather from the right posterior side of the intestinal loop and attains to ca. 8 mm in length. There is a very prominent incubatory pouch issued from the right posterior part of the thorax, it may attain to 5 mm in length and contains up to five embryos and ova, which are arranged just as in species of *Distaplia*, namely those of the earlier stages occupy the distal part of the pouch. Both apertures are 6-lobed and opened directly to the exterior. Zooids are greenish yellow in colour when they are alive, but fade to yellowish white in preservatives. They are situated within the

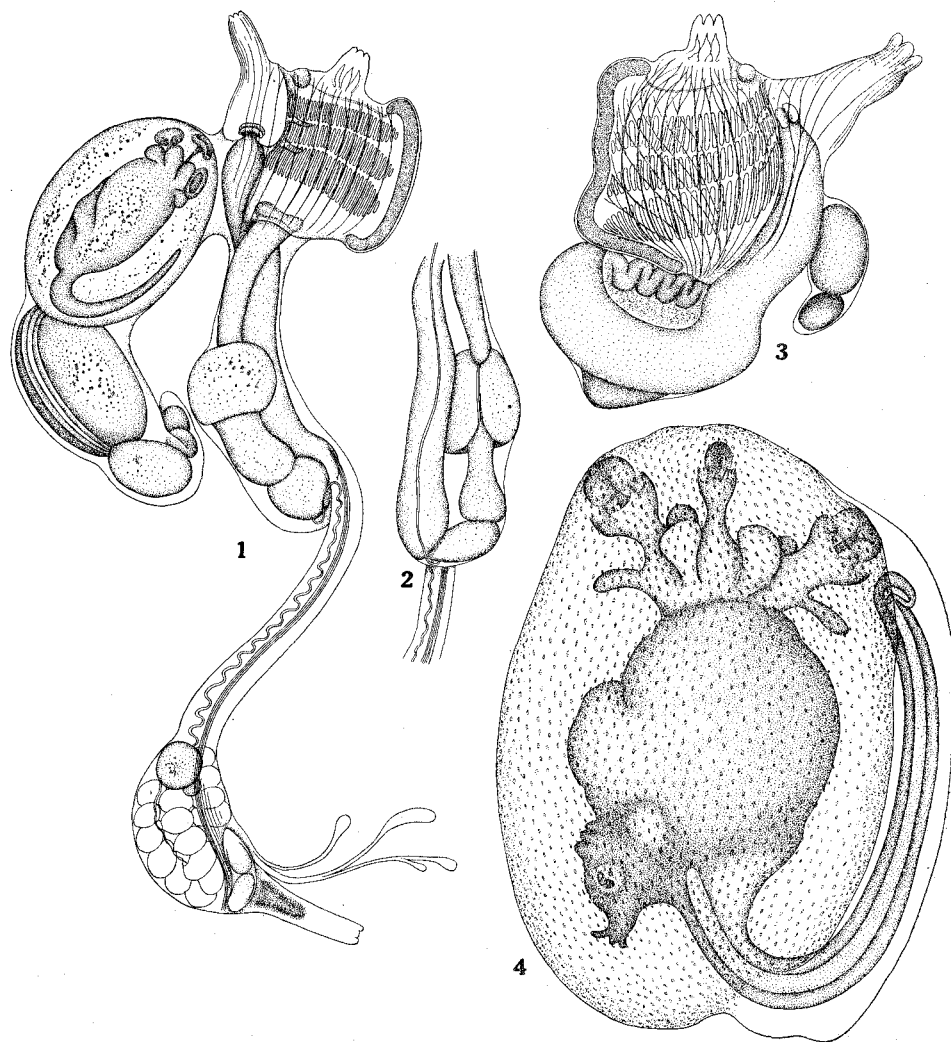


Fig. 3. *Pseudodistoma fragilis* n. sp.

1...Zooid, right side, enlarged; 2...Abdomen, left side, enlarged; 3...Zooid in a strongly contracted state, enlarged; 4...Embryo, $\times 35$.

test perpendicularly or slightly obliquely at places where the colony is thick, but laid horizontally or strongly obliquely at some thin places. No system is found in the arrangement of zooids.

Thorax: The atrial siphon of a moderate length. There are about a dozen longitudinal muscles on each side of the thorax, a few dorsal ones of which are rather delicate; besides 7-8 delicate oblique muscles are running beneath the longitudinal musculature on the ventral half of the thorax (3 of the Figure). Stigmatal rows three, 25 to 30 stigmata in each row, horizontal membrane is well developed along the transverse vessels. Tentacles six, all very stout; the ciliated groove is an oval orifice, dorsal languets are displaced slightly to the left side from the dorso-median line. The anus is bilobed and opened at the level of the second transverse vessel.

Abdomen: The stomach is located near the middle of the abdomen and with the quite smooth surface. The hind-stomach and the mid-intestinal region are very distinct, the latter is laid horizontally at the posterior end of the abdomen or obliquely with its distal end at the posterior end of the abdomen. The proximal end of the rectum is swollen, but devoid of coeca.

Postabdomen: The gonad is contained in the swollen part near the rear end of the postabdomen, where the ovary is situated just in front of the testis. Testicular follicles 21 to 39, being ca. 30 on an average. The heart is located at the distal end of the testis. A pair of longitudinal muscle bands are running along the whole length of the abdomen. One or two vascular appendages are issued from the cardiac area of the postabdomen; they are often ramified.

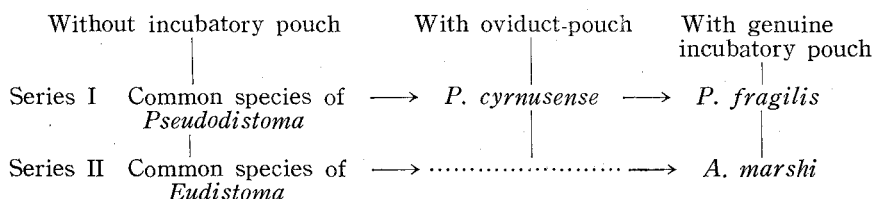
Larva: Larvae are very large and oval in outline. They are 2.3 mm to 2.6 mm in length of the trunk and width/length is 0.60 to 0.67. The tail is somewhat shorter than the trunk. The larval test is granulated. Three cup-shaped attachment processes are arranged linearly. There are two pairs of ampullae at the base of the attachment processes, besides the dorsal and ventral processes have each a finger-shaped process near the middle of the outer side of the peduncle. The sensory organ is located near the posterior end of the trunk, two pigment flecks are arranged dorso-ventrally.

Remarks: The present new species resembles most closely *Pseudodistoma cyrnusense* PÉRÈS from Corsica in the Mediterranean Sea in the shape of the encrusting flat colony, the delicate consistency of the test, the general colouration of zooids and in the situation and number of testicular follicles. In *P. cyrnusense*, however, stigmata in each row are only 12 to 15 on one side and the oviduct plays the rôle of the incubatory chamber along the whole length, without forming any genuine incubatory pouch. Thus these two species can't be considered as being identical with each other. And for the present new species, the name *fragilis* is proposed from the delicate and extremely fragile character of the test.

Now it is evident that the present species belongs to the genus *Pseudodistoma* if the existence of the incubatory pouch is put out of the discussion, because the zooid has a very distinct postabdomen, three stigmatal rows, smoothly walled stomach and branchial and atrial apertures both opening directly to the exterior. Then, what is

the relationship between the present form and the genus *Distaplia*? The existence of the incubatory pouch seems to be the sole characteristic common to these two. Some species of *Distaplia* have the gonad kept in an elongated protuberance from the abdomen as shown in *D. mikropnoa* (SLUITER), in such cases, however, the protuberance is issued from the left side of the intestinal loop and the heart is left on the right side of the intestinal loop, being never moved into the distal portion of the protuberance. The present form has only three stigmatal rows which are devoid of parastigmatic vessels, although the absence of parastigmatic vessels can't be accepted as one of the definite characteristics differentiating the present species from *Distaplia*, because *D. mikropnoa* (SLUITER) seems to be devoid of such vessels too. The existence of three stigmatal rows is, however, very unique. Moreover, there is no form in *Distaplia*, in which the atrial aperture opens directly to the exterior.

Then comes the turn to discuss on the incubatory pouch. The structure of the oviduct in *P. cyrnusense* PÉRÈS, which plays the rôle of the incubatory pouch, seems to show an intermediate state between the present new species with a distinct incubatory pouch and other species of *Pseudodistoma*, which are devoid of any incubatory pouch. There is another form which has an incubatory pouch, but does not belong to Holozoinae; this is *Atopozoa marshi* BREWIN known from Western Australia. The structure of the zooid of this compound ascidian is quite the same as that of *Eudistoma*, excepting for the existence of the incubatory pouch in the former.



All these forms conform one another in that they have three stigmatal rows without parastigmatic vessels, the atrial aperture opening directly to the exterior and the stomach smoothly walled. It is very interesting that the formation or the existence of the incubatory pouch is found in two groups of allied forms, the difference between these groups lies in the sole point that the postabdomen is formed in *Pseudodistoma*, while it is absent in *Eudistoma* and *Atopozoa*. The appearance of the postabdomen in *P. cyrnusense* and *P. fragilis* seems to show a rather primitive stage to the formation of the perfect postabdomen found in other species of *Pseudodistoma* and many species of other genera of Polyclinidae.

It might be possible to extend the definition of the subfamily Holozoinae to include *P. fragilis* and *A. marshi* which have three stigmatal rows without parastigmatic vessels and the atrial aperture opening directly to the exterior, here the difference between the postabdomen of *P. fragilis* and the genital protuberance in some species of *Distaplia* is put aside. Now the problem is to judge which is phylogenically more significant the existence of the incubatory pouch or the affinity between the forms in

respective series (Series I and II). At present, it seems more reasonable to consider the latter as being phylogenically more important than the former.

Next comes the question, which is more significant phylogenically the formation of the incubatory pouch or that of the postabdomen. The existence of various degrees of development of the genital protuberance in species of *Distaplia* seems to support the possibility that *Pseudodistoma* and *Eudistoma*, including *Atopozoa* within the latter, are phylogenically related with each other so closely that they can't be placed respectively in different families Polyclinidae and Polycitoridae. Of course, more crucial examination on much more specimens are necessary to settle the present problem. Probably, in future, there might occur the same problems on some other genera in these families and also the necessity to reorganize these families on more reasonable phylogenical relationship.

4. *Distaplia systematica* n. sp.

(Fig. 4)

One colony collected on April 11, 1952 from the coast of Hatakezima in the vicinity of the Seto Marine Biological Laboratory, Sirahama. It consists of six oval or round cormidia of which the largest one containing three systems is 9 mm in long diameter, while others are including each only a single system and less than 5 mm in diameter. The height of cormidia attains to 8 mm. These cormidia are connected with one another by broad and flat stolon-like basal extension of the test, which is creeping on the rock or the basal portion of some sea-weeds and wholly encrusted with detritus and faecal pellets ejected from the zooids. Each system consists of from 6 to 18 zooids surrounding a wide common cloacal aperture. The living specimen is coloured pinkish along the periphery of the cormidium and purplish brown at the centre; this colouration turns to simple greenish gray by preservation. The test is thin, very soft and transparent at the distal end of the cormidium, but rather opaque in other parts of the colony. Zooids are up to 2.1 mm in length in a fairly contracted state, of which 1.4 mm is occupied by abdomen. They are situated perpendicularly in the test, the thorax being in the distal part of the cormidium, swollen out of the common basal portion of the colony, while the abdomen being embedded in the basal portion. The margin of the common cloacal aperture is crenated.

Thorax: The branchial aperture 6-lobed. The atrial languet is considerably long and most frequently trifid at the tip. About twenty strongly developed transverse muscles on each side of the thorax, longitudinal muscles being quite obsolete. A pair of strong longitudinal muscles along the dorso-median line of the branchial sac. Stigmatal rows four. The anus is bilobed.

Abdomen: The surface of the stomach is usually smooth, rarely with a few faint striations. A vascular appendage is issued from the right side of the intestinal loop. Gonad immature in every examined zooid.

Remarks: The appearance of the colony and the thoracic musculature consisting of only transverse muscles are the characteristics of the present new species. Other locality: Simoda, Izu.

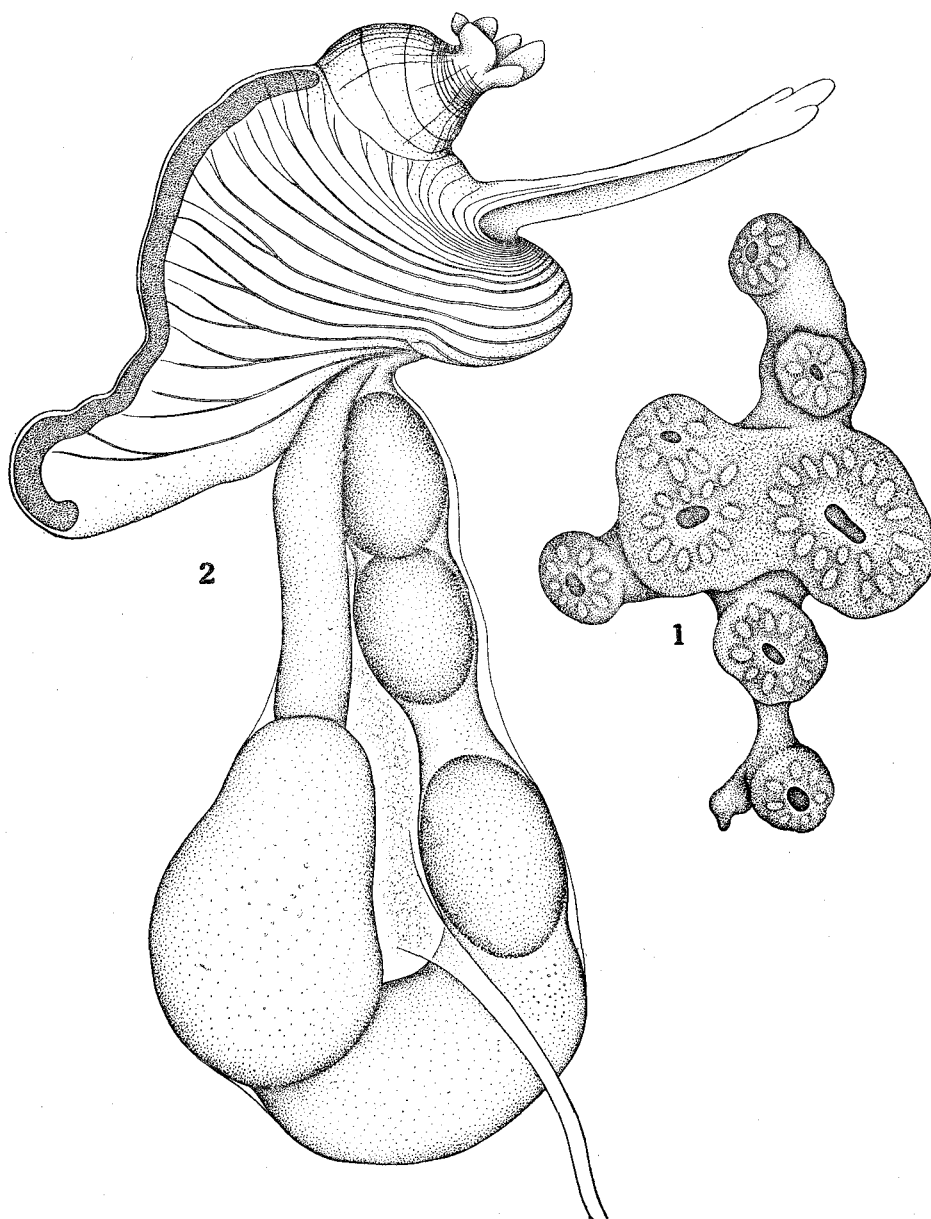


Fig. 4. *Distaplia systematica* n. sp.
1...Colony, enlarged; 2...Zooid, $\times 73$.

5. *Polycarpa pedata* HERDMAN, 1881

(Figs. 5 and 6)

- Polycarpa pedata*—HERDMAN, W. A. (1881): Preliminary report on the Tunicata of the Challenger Expedition. Cynthiadae. Proc. Roy. Soc. Edinburgh, Vol. 11, p. 71.
 HERDMAN (1882): Challenger Report, Vol. VI, Tunicata, p. 180, pl. 24 figs. 1-2.
 TRAUSTEDT (1884): Vidensk. Meddel. Nat. For. Kjøbenhavn, ann. 1884, p. 48.
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 HASTINGS (1931): Great Barrier Reef Exped., Sci. Rep. Vol. IV, No. 3, p. 74.
Styela whiteleggei—HERDMAN (1899): Catalogue Australian Museum, Sydney. No. 17, pp. 40-41, Pl. Cyn. II figs. 6-7; Pl. Cyn. XIV figs. 1-6.
Pandocia pedata—VAN NAME (1918): U. S. Nat. Mus. Bull. 100, Vol. 1, Part 2, pp. 97-99, Text-fig. 49, Pl. 23 figs. 1-3.

Three specimens collected from the vicinity of the Seto Marine Biological Laboratory.

- No. 1...55 mm long elongate individual carried on the back of a dromiid crab brought into the aquarium on April 24, 1952 (2 in Fig. 5).
 No. 2...37 mm long elongate individual collected by Mr. T. YAMAMOTO on November 20, 1951 near the rocky islet "Sisōzima" in the vicinity. Attached to the substratum by the ventral side (1 in Fig. 5).
 No. 3...80 mm high, 49 mm wide dorso-ventrally and 42 mm laterally; attached to the substratum by the left-ventral side (1 in Fig. 6). Details of the date and habitat unknown.

In two of the three specimens (Nos. 1 and 2), both apertures are nearly sessile; the branchial aperture is terminal and the atrial aperture is situated near the posterior end of the body widely apart from the branchial, while in the other specimen, both apertures are opened each on a short siphon, the branchial siphon is terminal and the atrial is situated near the branchial, although the base of the atrial siphon is located far posteriorly. The apertures are surrounded in two smaller specimen by lobules up to a dozen in number. The test is leathery, hard and strong and attains to 8-9 mm in thickness at some parts of the basal portion. The surface is smooth, but with a few irregularly formed grooves and quite free from foreign matters in two smaller specimens, but partly covered by some hydrozoans and algae in the largest individual. The living specimen is pretty orange in colour, sometimes sprinkled with reddish spots (Nos. 1 and 2) or grayish white to pinkish gray (No. 3). The colour fades to yellowish gray in formalin. The inner surface of the test is not glistening. All specimens are devoid of the pedal extension of the test. The mantle is dark purplish brown or dark brownish, the viscera are also pigmented in the same colouration. The mantle is considerably thick, attaining to 2 mm at some thick portions. The branchial aperture is terminal and the atrial siphon is situated near the middle of the body. There are many endocarps on the inner surface of the mantle (3 and 4 in Fig. 5). Atrial velum well developed and with small tentacles.

Branchial sac: Inner longitudinal vessels are arranged as:

55 mm long individual.

Left D. 20 (39) 7 (38) 12 (39) 10 (32) 3 (5) ? V.

Right D. 18 (28) 10 (35) 13 (37) 13 (38) 12 V.

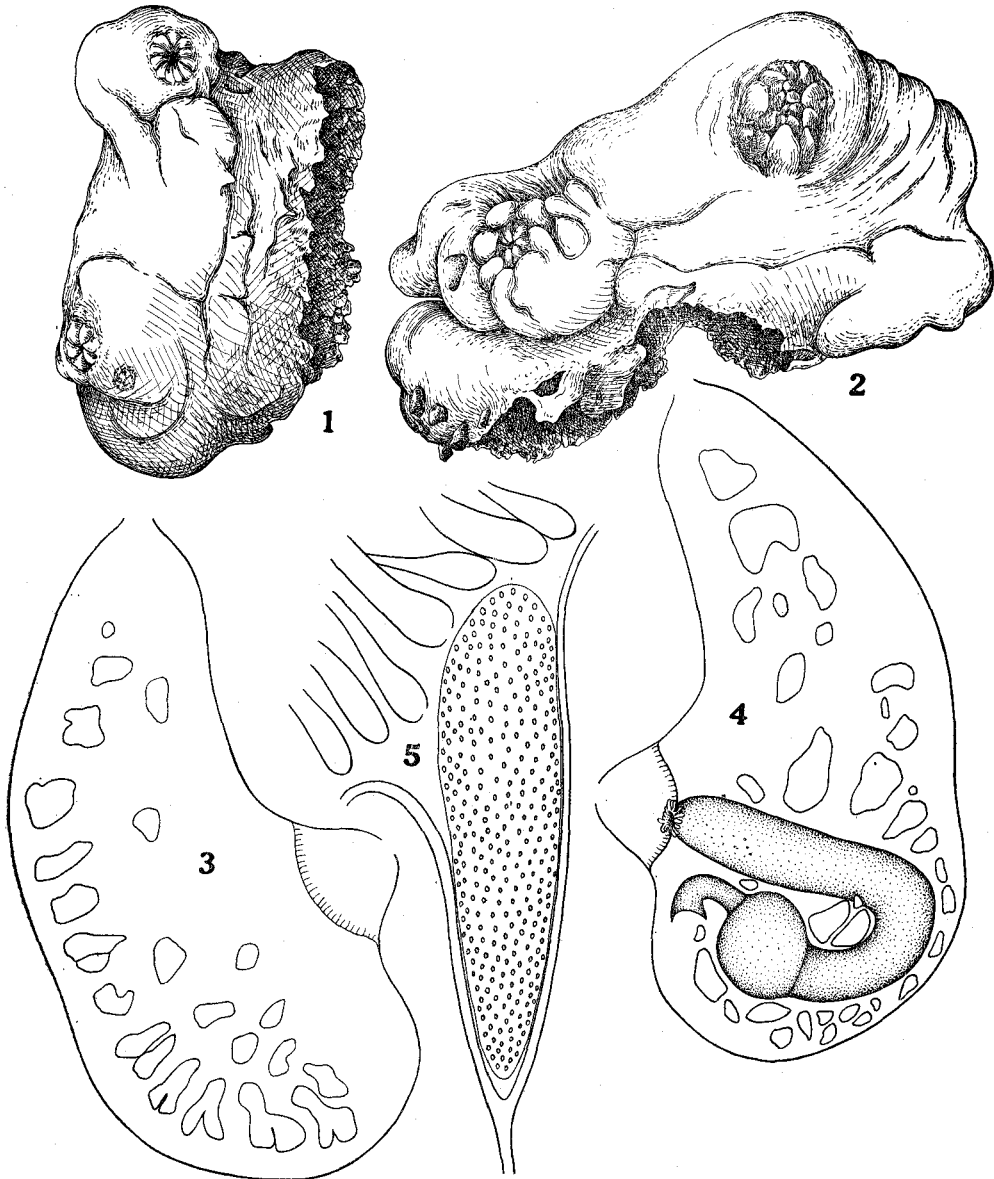


Fig. 5. *Polycarpa pedata* HERDMAN.

1...37 mm long specimen, 2...55 mm long specimen, 3...Right half of mantle body of the same specimen, from inside; 4...Left half of mantle body of the same specimen, from inside; 5...Dorsal tubercle of the same specimen, enlarged.

80 mm long individual.

Left D. 18 (33) 8 (34) 9 (27) 10 (23) 10 V.

Right D. 15 (27) 9 (37) 8 (35) 8 (35) 9 V.

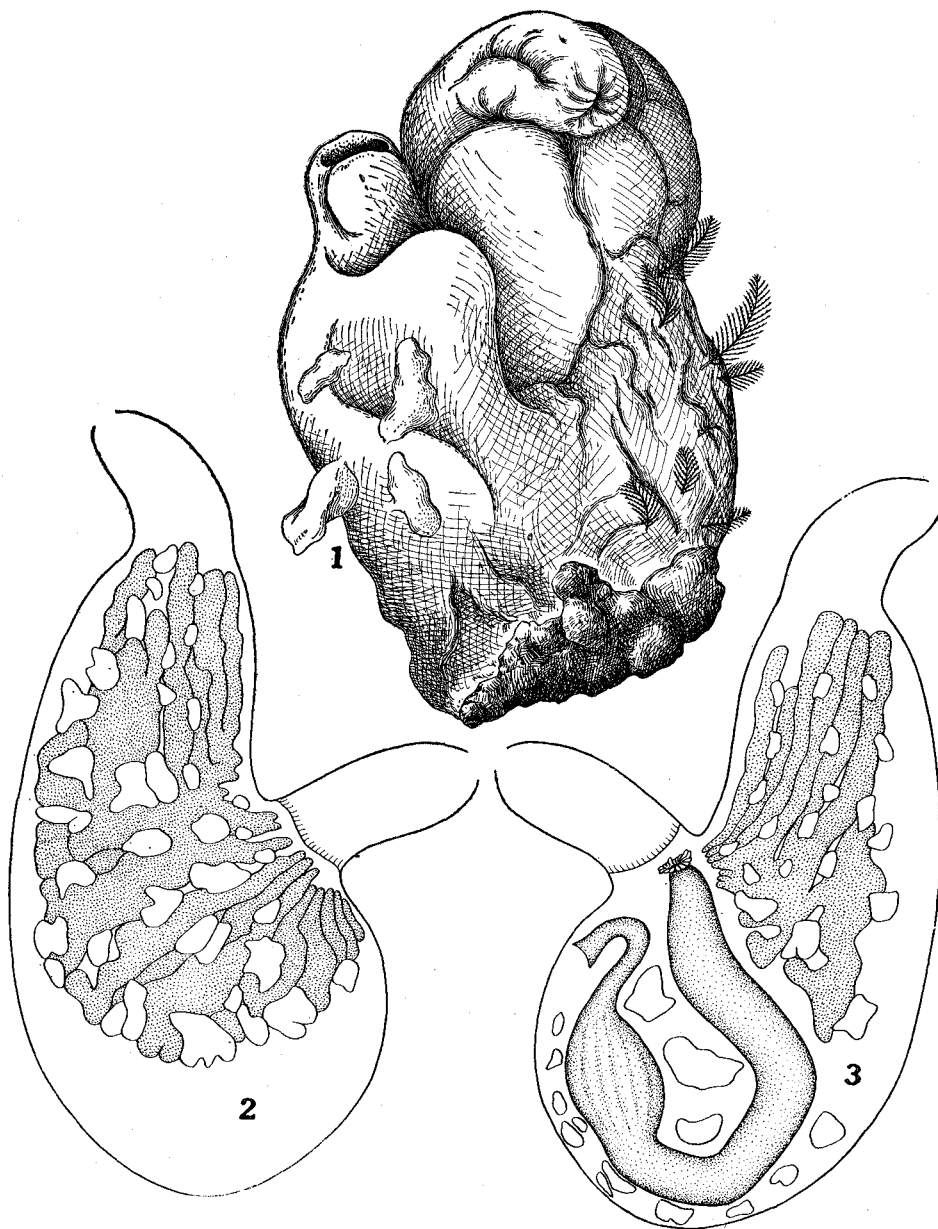


Fig. 6. *Polycarpa pedata* HERDMAN.

1...80 mm long specimen, 2...Right half of mantle body, from inside; 3...Left half of mantle body, from inside.

A rudimentary fifth fold was observed in the posterior part of the left side in the 55 mm long individual. Seven to fifteen thinner transverse vessels are found between each pair of thicker ones, parastigmatic vessels practically absent. From three to six small stigmata in each mesh. Tentacles 23 to 34, larger and smaller ones are differentiated. The dorsal tubercle is very large and elongate, about 3 mm long in the 55 mm long individual (5 in Fig. 5); the ciliated grooves consist of numerous orifices, 180 in the 80 mm long specimen and 300 or thereabout in the 37 mm and 55 mm long individuals.

Alimentary system: The alimentary canal figures a very simple loop, without forming the second intestinal loop. Three endocarps are found in the intestinal loop. The stomach round or oval in outline; the surface is quite smooth, although several longitudinal plications of the inner wall are seen through; pyloric coecum absent. The anus is fringed with 15-17 lobules.

Gonad: The gonad was found only in the 80 mm long individual (2 and 3 in Fig. 6). The gonads are considered as being originally of elongate form, but actually many of them are anastomosing complicatedly and form an irregularly shaped genital mass on each side. On the present specimen, seven genital ducts are found on the left side and 14 ones on the right side. The existence of some elongate genital sacs seems to show the close relationship between the present species and the genus *Cnemidocarpa*.

Remarks: A kind of pontinid shrimp was found in the branchial sac in all of the three specimens.

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